6/23/20 C-300-19

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May, 1980

25th ANNUAL McGRAW-HILL SURVEY OF BUSINESS' PLANS FOR RESEARCH AND DEVELOPMENT EXPENDITURES, 1980-83

Executive Summary

Industrial research and development (R&D) spending is expected to grow by 13% in 1980 to $41.7 billion, according to McGraw-Hill's 25th annual R&D survey.

If all plans are met, first place in the R&D spending league will be taken over this year by the electrical machinery industry, which intends to boost R&D expenditures by 20% to $9.3 billion. Aerospace, the leading R&D spender in the past, plans to raise 1980 spending by just 3% to $8.7 billion. Together, the electrical machinery and aerospace industries account for more than two-fifths of total industrial R&D spending.

The survey also finds that industry expects to spend $53.3 billion on R&D in 1983, up 28% from the 1980 level.

Industries planning the biggest increases in R&D expenditures in 1980, other than electrical machinery, are: paper (21%), nonferrous metals (19%), machinery (19%), food (18%), chemicals (16%), instruments (15%), steel (14%), and petroleum (14%).

Of total R&D spending, manufacturers plan to devote 41% to new product development, 36% to product improvement, and 23% to new processes. The industries concentrating most on new products are instruments (80% of R&D for new products) and autos, trucks, and parts (60%).

The survey also finds that industry plans to spend $1.5 billion this year on pollution control-related and $1.3 billion on energy-related R&D.

6/29/80 C 5900-19

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BUSINESS' PLANS FOR RESEARCH AND DEVELOPMENT EXPENDITURES, 1980-83

Even though 1980 promises to be a year of economic recession, U.S. companies plan to boost research and development (R&D) expenditures by 13% over 1979, according to McGraw-Hill's 25th annual survey of R&D spending. If firms stick to current plans, R&D spending in 1980 would rise to $41.7 billion, compared to an estimated $37 billion in 1979.

In 1983, the survey finds, industry expects to spend $53.3 billion on R&D, up 28% from the 1980 level.

Stripped of inflation, R&D spending in 1980 could rise about 3%. By contrast, inflation-adjusted R&D spending declined in the past two recessions.

The projected 13% increase (based on responses from 350 companies) may prove to be high, however. The reason: At the time the survey was conducted, March and early April, hard evidence of a recession was just starting to accumulate. Plans reported by survey respondents, then, may not have reflected the recent bad economic news. And if firms adjust plans in order to cope with recession, they may cut back R&D spending as they did in 1970 and 1974-75.

Spending by Industry

First place in the R&D spending league will change hands this year if all plans are met. The electrical

machinery industry, expecting to up 1980 spending by 20% to $9.3 billion, would take first place from the aerospace industry (Table I). Aerospace intends to increase R&D spending by just 3% in 1980 to $8.7 billion. If expectations are met, the electrical machinery industry's share of total R&D spending would rise from 21% in 1979 to 22% in 1980, while aerospace's share would decline from 23% to 21%. (R&D spending by both the electrical machinery and aerospace industries is heavily funded by the government.)

The industry planning the biggest boost in 1980 R&D spending is paper, which expects expenditures to rise by 21% to $507 million. Other industries anticipating large increases in R&D spending are: nonferrous metals (19%), machinery (19%), food (18%), chemicals (16%), instruments (15%), steel (14%) and petroleum (14%).

R&D Intensiveness

The number of dollars an industry spends measures the importance of that industry in the overall performance of R&D. The importance of R&D to an industry, on the other hand, may be measured by the industry's R&D spending as a percentage of sales (Table VI). By this measure, aerospace is by far the most R&D-intensive industry, with an expected R&D/sales ratio of 17.4% in 1980. Electrical machinery's ratio is 7.2%, followed by instruments (4.9%), autos, trucks, and parts (3.3%), machinery (3.2%), and

chemicals (2.7%). The average for all industry is 2.1%, which compares to the peak ratio of 2.95% in 1964.

Another measure of R&D intensiveness--R&D spending as a percentage of capital spending (Table VII)--produces similar information: That is, both measures provide the same ranking of industries' R&D intensiveness. The R&D/capital spending ratio is particularly striking, though, for aerospace and electrical machinery: Each industry spends more on R&D than it does on plant and equipment. The instruments industry, meanwhile, spends about as much on R&D as it does on capital goods.

R&D Goals

R&D spending has three purposes--development of new products, development of new processes, and improvement of existing products. Manufacturers as a whole plan to devote 41% of 1980 R&D spending to new product development, while allocating 36% of spending to product improvement and 23% to new processes (Table III).

Industries expecting to concentrate their 1980 R&D heavily on new products are instruments (80%) and autos, trucks, and parts (60%). Not surprisingly, these two industries also expect a large share of their 1983 sales to be in new products. The auto industry expects two-thirds

and instruments expects one-third of sales in 1983 to come from new products (Table II). Manufacturers on average expect new products to account for only 15% of 1983 sales.

Seven industries plan to allocate at least half of their 1980 R&D spending to improving existing products: steel (76%), nonferrous metals (66%), machinery (50%), textiles (51%), and fabricated metals (49%). As for development of new processes, only the petroleum industry plans to spend more than half (52%) of its R&D funds for this purpose.

Pollution Control and Energy R&D

Since 1973, industry has spent an average of about $1½ billion per year to research and develop ways of combatting pollution control. Pollution control-related R&D spending dipped to $1.2 billion last year, but is expected to return to a $1½ billion level in 1980. Moreover, industry expects R&D expenditures on pollution control to rise to an annual average of $2.1 billion in the years 1981-83.

The industry expecting to spend the most R&D funds on pollution control in 1980--$312 million--is electrical machinery. Autos, trucks, and parts, which last year slightly outspent electrical machinery, plans to spend $260 million this year on pollution control-related R&D. Other industries with large budgets in this area are chemicals ($213 million) and petroleum ($202 million). All of these industries plan to

increase the amounts of R&D funds spent on pollution control in 1981-83.

Another area industrial R&D has been focusing on in recent years is energy. In 1980, industry plans to spend $3.3 billion on energy-related R&D, up 16% from 1979 (Table V). Spending is expected to jump in 1981-83 to an annual average of $4.6 billion.

The major factor in energy R&D spending is petroleum, which is budgeting $1.2 billion for 1980. The autos, trucks; and parts industry plans to spend $602 million on energy-related R&D. The electrical machinery, aerospace, chemical, and machinery industries also have relatively large energy-related R&D budgets for 1980.

The survey also finds that 14% of manufacturers' R&D spending in 1980 will be made necessary by government regulation. The autos, trucks, and parts industry reports that 57% of its R&D spending this year will be due to government regulations, while petroleum companies as a group say that 25% of spending will be in response to regulations. Among nonmanufacturing industries, gas utilities and electric utilities expect spending due to regulation to be 49% and 44%, respectively, of total R&D.

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NOTE: The other manufacturing category in the tables includes lumber, wood products and furniture, tobacco, printing and publishing, leather, jewelry, toys, and transportation equipment other than autos, trucks and parts and aerospace. The nonmanufacturing category includes, mining, construction, electric and gas utilties, commercial enterprises and transportation.

Sources: National Science Foundation, McGraw-Hill Publications Company-Economics Department.

TABLE I

RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1978 Actual	1979 Estimated	-----Planned--- 1980	1983	1979-80 % Change	1980-83 % Change
Iron & Steel	$ 260	$286	$ 326	$ 385	14%	18%
Nonferrous Metals	282	290	345	427	19	24
Electrical Machinery	6,743	7,748	9,284	12,683	20	37
Machinery	4,459	4,789	5,678	8,137	19	43
Autos, Trucks & Parts	3,783	4,343	4,560	5,198	5	14
Aerospace	7,680	8,448	8,735	9,735	3	11
Fabricated Metals	397	374	409	472	9	15
Instruments	1,689	1,725	1,986	2,589	15	30
Stone, Clay & Glass	331	384	429	549	12	28
Chemicals	3,594	3,935	4,566	6,230	16	36
Paper & Pulp	394	420	507	757	21	49
Rubber	504	558	586	733	5	25
Petroleum	1,071	1,312	1,494	2,027	14	36
Food & Beverages	431	484	570	723	18	27
Textile Mill Products & Apparel	87	94	102	125	9	23
Other Manufacturing	547	621	714	942	15	32
ALL MANUFACTUPING	32,254	35,811	40,290	51,711	13	28
Nonmanufacturing	1,152	1,178	1,384	1,637	17	18
ALL INDUSTRIES	33,406	36,989	41,674	53,349	13	28

*Source: National Science Foundation.

TABLE II

NEW PRODUCTS SALES - 1983*

INDUSTRY	Percent of 1983 sales	Billions of Dollars
Iron & Steel	7%	$ 6.42
Nonferrous metals	4	3.60
Electrical Machinery	17	32.60
Machinery	15	38.87
Autos, Trucks & Parts	67	135.87
Aerospace	11	8.00
Fabricated Metals	17	29.21
Instruments	31	16.96
Stone, Clay & Glass	10	6.97
Other Durables	14	25.06
TOTAL DURABLES	22	303.56
Chemicals	10	21.98
Paper & Pulp	6	6.02
Rubber	8	4.85
Petroleum	5	10.37
Food & Beverges	13	46.04
Textile Mill Products & Apparel	17	11.33
Other Nondurables	14	8.53
TOTAL NONDURABLES	8	109.14
ALL MANUFACTURING	15	412.07

*Products not produced in 1979. Sales figures are based on company data classified by major product line.

TABLE III

PERCENT OF RESEARCH & DEVELOPMENT EXPENDITURES GOING FOR
NEW PRODUCTS, NEW PROCESSES & IMPROVEMENT OF EXISTING PRODUCTS

	In 1979			In 1980		
INDUSTRY	New Products	New Processes	Improving Existing Products	New Products	New Processes	Improving Existing Products
Iron & Steel	20%	9%	71%	15%	9%	76%
Nonferrous Metals	5	27	68	7	27	66
Electrical Machinery	32	30	38	33	32	35
Machinery	40	8	52	40	10	50
Autos, Trucks & Parts	60	19	21	60	20	21
Aerospace	43	22	35	46	22	33
Fabricated Metals	33	17	50	35	16	49
Instruments	80	11	9	80	11	9
Stone, Clay & Glass	37	33	30	37	34	29
Chemicals	31	23	45	30	20	50
Paper & Pulp	25	24	51	22	26	52
Rubber	29	22	49	30	22	48
Petroleum	23	47	30	22	52	26
Food & Beverages	20	20	60	20	20	60
Textile Mill Products & Apparel	12	39	49	12	39	49
Other Manufacturing	36	18	47	38	23	39
ALL MANUFACTURING	40	22	37	41	23	36

TABLE IV

TOTAL R & D POLLUTION CONTROL EXPENDITURES
(Millions of Dollars)

INDUSTRY	Actual 1979	Planned 1980	% Change 1979-80	Planned 1981-83 (Annual Average)
Iron & Steel	$ 25	$ 29	16%	$ 45
Nonferrous Metals	9	10	11	13
Electrical Machinery	221	312	41	496
Machinery	47	95	102	141
Autos, Trucks & Parts	238	260	9	297
Aerospace	72	75	4	83
Fabricated Metals	11	12	9	14
Instruments	13	20	54	27
Stone, Clay & Glass	19	21	11	28
Chemicals	171	213	25	288
Paper & Pulp	37	40	8	64
Rubber	18	20	11	35
Petroleum	177	202	14	274
Food & Beverages	24	26	8	29
Textile Mill Products & Apparel	4	5	25	6
Other Manufacturing	11	13	18	17
ALL MANUFACTURING	1,097	1,353	23	1,855
ALL NONMANUFACTURING	94	141	50	255
ALL BUSINESS	1,191	1,495	26	2,109

TABLE V

TOTAL ENERGY RELATED R & D EXPENDITURES
(Millions of Dollars)

INDUSTRY	Actual 1979	Planned 1980	% Change 1979-80	Planned 1981-83 (Annual Average)
Iron & Steel	$ 37	$ 52	39%	$ 61
Nonferrous Metals	14	17	19	29
Electrical Machinery	262	322	23	486
Machinery	121	207	71	348
Autos, Trucks & Parts	575	602	5	686
Aerospace	308	308	0	389
Fabricated Metals	28	31	10	35
Instruments	61	76	25	101
Stone, Clay & Glass	37	42	13	62
Chemicals	195	242	24	555
Paper & Pulp	23	30	30	53
Rubber	23	31	37	48
Petroleum	1,034	1,177	14	1,597
Food & Beverages	14	17	29	24
Textile Mill Products & Apparel	7	8	16	10
Other Manufacturing	27	34	25	59
ALL MANUFACTURING	2,765	3,198	16	4,542
Nonmanufacturing	113	145	28	97
ALL INDUSTRY	2,878	3,343	16	4,639

TABLE VI

RESEARCH & DEVELOPMENT AS A PERCENT OF SALES*

INDUSTRY	1979	1980	1983
Iron & Steel	.42%	.44%	.40%
Nonferrous Metals	.50	.53	.49
Electrical Machinery	7.00	7.21	6.59
Machinery	3.04	3.23	3.15
Autos, Trucks & Parts	3.36	3.33	2.57
Aerospace	19.29	17.36	13.27
Fabricated Metals	.34	.33	.27
Instruments	4.75	4.90	4.69
Stone, Clay & Glass	.80	.81	.79
Chemicals	2.64	2.67	2.74
Paper & Pulp	.64	.70	.72
Rubber	1.25	1.25	1.17
Petroleum	.98	.93	.90
Food & Beverages	.21	.21	.20
Textile Mill Products & Apparel	.20	.20	.19
Other Manufacturing	.24	.25	.26
ALL MANUFACTURING	2.12	2.12	1.98

*Sales figures are based on company data classified by major product line.

TABLE VII

RESEARCH & DEVELOPMENT AS A PERCENT OF CAPITAL SPENDING

INDUSTRY	1979	1980	1983
Iron & Steel	9.63%	9.25%	9.74%
Nonferrous Metals	11.11	9.35	7.58
Electrical Machinery	149.86	141.91	143.24
Machinery	56.94	63.06	62.15
Autos, Trucks & Parts	81.03	69.70	69.64
Aerospace	402.29	296.73	443.45
Fabricated Metals	13.50	9.43	13.05
Instruments	98.57	97.38	111.29
Stone, Clay & Glass	13.15	11.27	17.64
Chemicals	45.97	44.21	49.50
Paper & Pulp	8.61	7.13	13.30
Rubber	31.00	19.79	18.38
Petroleum	7.89	6.93	6.53
Food & Beverages	9.57	10.92	12.55
Textile Mill Products & Apparel	8.87	7.80	9.15
Other Manufacturing	9.02	9.39	13.53
ALL MANUFACTURING	45.38	43.83	46.89
Nonmanufacturing	1.20	1.30	1.38
ALL INDUSTRY	20.89	20.98	23.34

TABLE VIII

PERCENT OF R & D UNDERTAKEN AS A RESULT OF GOVERNMENT REGULATION

INDUSTRY	Estimated 1979	Expected 1980
Iron & Steel	12%	12%
Nonferrous Metals	6	6
Electrical Machinery	7	7
Machinery	5	6
Autos, Trucks & Parts	57	57
Aerospace	3	3
Fabricated Metals	2	5
Instruments	7	7
Stone, Clay & Glass	12	16
Other Durables	10	13
TOTAL DURABLES	13	14
Chemicals	10	10
Paper & Pulp	15	14
Rubber	5	5
Petroleum	24	25
Food & Beverages	15	15
Textiles	20	22
Other Nondurables	3	4
TOTAL NONDURABLES	13	14
TOTAL MANUFACTURING	13	14
Electric Utilities	27	44
Gas Utilities	49	49